

Mathematics 108 Syllabus, Spring 2009

Instructor: David Lutzer; office = Jones 114; phone = 221-4006; e-mail = lutzer@math.wm.edu; and website = <http://www.math.wm.edu/~lutzer>

Office Hours: No appointment is needed on [MWF, 9am to 10:50] and [Tuesday, 9:30-11:30]. Additional hours are available by appointment.

Text: *Brief Calculus and its Applications, Eleventh Edition* by Goldstein, Lay, and Schneider. My plan is to cover most of Sections 1.1 through 7.3. Additional handouts will be available on line.

Class Meetings: The class meets on MWF, 11am, in Small 109 and on Tuesday at 8:30am in Small 113. History reveals a high correlation between missing class and low final grades.

Homework Quizzes and Exams: Homework will be assigned and discussed each class meeting. On Tuesday of any week in which we do not have an hour exam, there will be a ten minute homework quiz, starting on February 3. Homework quiz totals will be adjusted to count as 100 of the 600 course points.

There will be three one-hour, in-class tests plus a three-hour final exam. Each hour exam will be worth 100 points, and the final will be worth 200 points. The hour examinations are scheduled for Tuesday, February 17; Tuesday, March 24; and Tuesday, April 21. The final exam is on Tuesday, May 12, 8:30am.

Changing the date or time of the final exam requires permission of the Dean. Other exams and quizzes can be rescheduled for students who have university activity or religious holiday conflicts, provided you contact me in advance in order to re-schedule an exam or quiz. Rescheduling for medical reasons requires a note from the Heath Center or from a doctor. Missed quizzes and exams must be made up during the week in which they were originally scheduled. No quiz or hour exam scores are dropped. "Re-takes" of quizzes and exams are not allowed.

Grading: By the end of the term, each student will have a possible total of 600 points as follows: homework quizzes (100), mid-term hour tests (300) and final exam (200). Final letter grades will be assigned based on each student's percentage of the 600 points. Grading in Math 108 will follow the usual pattern of 90-100%, 80-89%, etc. For example, a final course average of 80 or 81 % will result in a B-minus, and an average of 88 or 89 % will yield a B-plus. Finally, this is not a course where "extra credit" work can be used to improve a grade.

Goals of Math 108: This is a completely different calculus course from the one (Math 111) that many other freshmen are taking. Our goal in Math 108 is to survey a wide spectrum of calculus techniques selected from single and multi-variable calculus, and to show you how these ideas are used in important applications in finance, economics, and social sciences. The heart of the course is word problems, and we will cover selected topics from Math 111, 112, and 212.

Because we want to survey so many topics, we will be forced to skip many things covered in Math 111. As a result, Math 108 will not prepare you for Calculus II (Math 112 or 132) or for later mathematics courses. If you are thinking about taking many science courses here (chemistry and physics, especially) or about graduate school in economics or finance, then you need to transfer into Math 111.

Warning: You cannot receive credit for more than one of Math 108, Math 111, and Math 131.

GER 1 status: Math 108 is also a GER1 course. To meet GER1 goals, it must include a substantial component of numerical calculations, plus mathematical explanations of why the calculations work and a spectrum of applications that would be recognized as such by an educated lay person. The applications in our course will be primarily financial, but there will also be applications from the social sciences and biology. The handout "Highlights of Math 108" (see reverse) will show you the kinds of applications at the heart of this course.

(1/15/2009)

The Highlights of Math 108

Math 108 is a GER1 course and so it must contain substantial numerical calculations, explanations of why the mathematical techniques used actually work, and problems that educated non-mathematicians would agree are real applications. In Math 108 we use calculators for most numerical calculations, and whenever possible we give geometric arguments to justify the mathematical techniques introduced in the course. As for applications, Math 108 is a course that focuses on word problems chosen for students who are interested in undergraduate business, social science, and finance and who have good algebra backgrounds ¹. The following problems show you the kind of applications studied in Math 108. The problems are real even though some of the numbers in the problems are made-up to simplify computations.

1) In a large sports arena, history tells us that we can sell 10,000 hamburgers per day if we charge \$2 per burger, and that raising the price to \$2.40 caused daily sales to drop to 8,000. It costs us 60 cents to make each hamburger. Assuming a linear demand curve, what price should we charge in order to maximize our profits?

2) In the late 1930s, a University of Oregon anthropologist discovered sandals made of tree bark in an Oregon cave. Chemical analysis revealed that the sandals contained about one-third of the carbon-14 found in living tree bark. When were the sandals made? (This discovery led researchers to double their estimates about when humans settled the Pacific Northwest.)

3) Suppose we have a linear demand curve for our product and a fixed production cost per unit. Suddenly our supplier raises the cost of materials by a certain amount. If our goal is to maximize profits, how much of that price increase should we pass on to our customers?

4) How can one tell whether consumer demand for a product is elastic at a certain price level, and why is it true that in an elastic demand situation, price and revenue move in opposite directions?

5) You owe your credit card company \$1,000 and make a plan to (a) stop using the card immediately, and (b) pay off the debt at the rate of \$20 per month. The card charges a continuous interest rate of 1% per month. How long will it take for you to pay off the debt?

6) In 1980, the USSR wanted to build a natural gas pipeline from its Siberian gas fields to some western European country, from which its natural gas would be distributed to buyers in Europe. But the USSR did not have the money to build the pipeline so it invited various European nations to lend the needed construction funds to the USSR, with repayment (in natural gas) to begin in 1985 when the pipeline would be complete. Negotiations with West Germany were successful and, in broad terms, the agreement was as follows. The Germans would lend 20 billion Deutsch marks to the USSR in 1980. Once the pipeline was completed in 1985, the USSR would begin repaying the loan by allowing the Germans to take, at no cost, a constant annual amount of natural gas, forever, from the pipeline. In 1980, the price of natural gas was 0.10 DM per cubic meter and this price was expected to be generally stable over the foreseeable future. In addition, the prevailing continuous interest rate was 10%. The Germans' bid was "In return for the 20 billion DM that we will lend you to build the pipeline, we will take K million cubic meters of natural gas each year, forever." The question is: What was K ?

¹See Algebra Prerequisites handout.